Aura Data System Working Group
Meeting Fall 2007

Aura Microwave Limb Sounder

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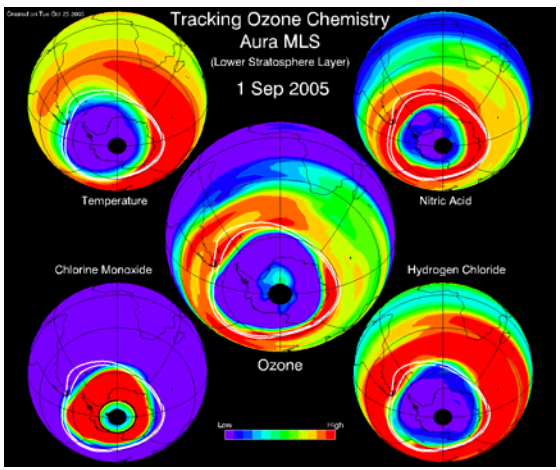
Pasadena, California
October 1, 2007

Outline



- Major Milestones
- Instrument Status
- SIPS Status
- Science Data Products
- Level 2 Processing Status
- MLS Data flow
- MLS Data Products for Version 2
- Current and Future Development
- Aids to Users
- Summary
- Useful Web Pages

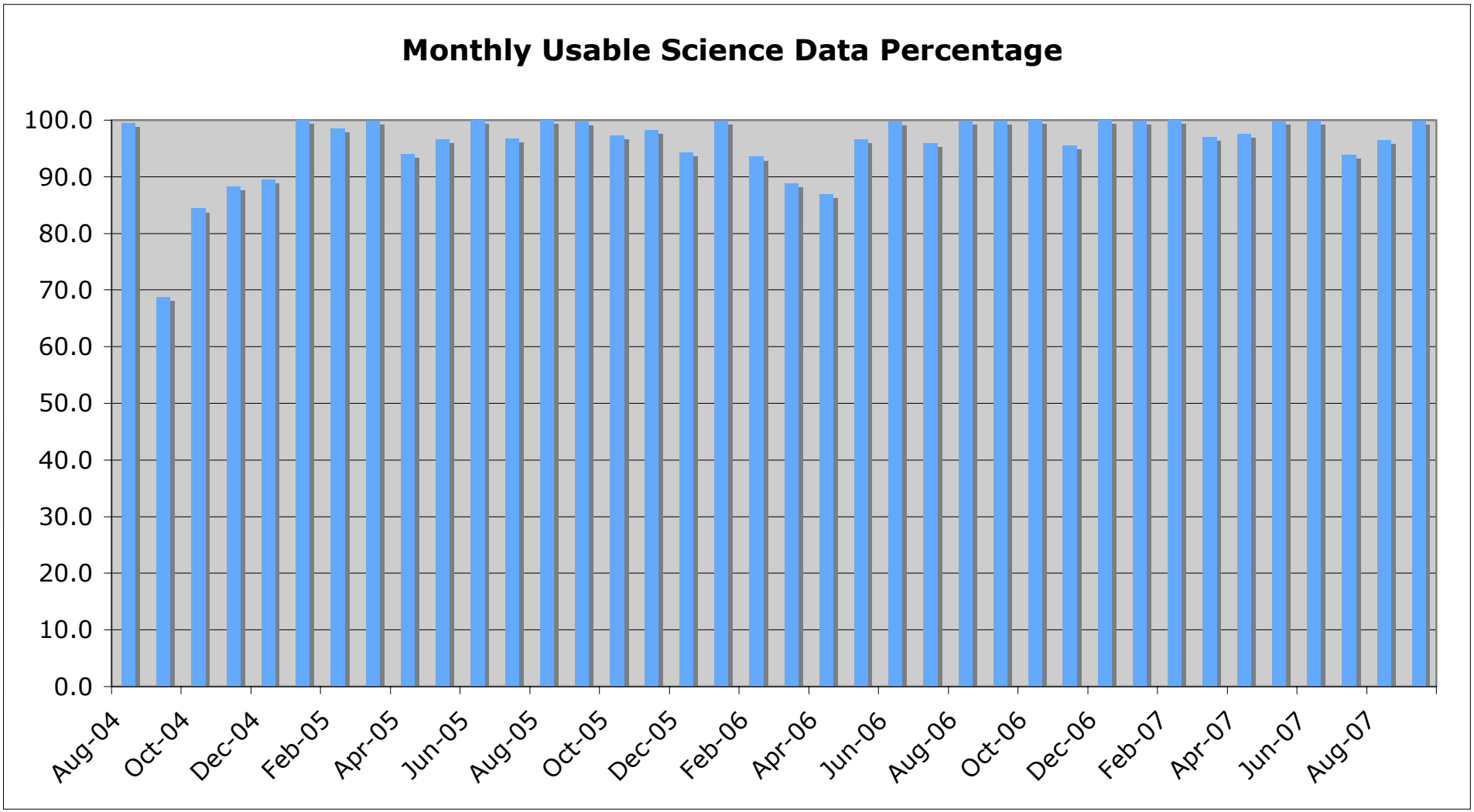
Major Milestones

- Major MLS milestones since launch (15 July 2005)
  - Full-up science observations start . . . . . 13 August 2004
  - V1.51 (first public release) data processing starts . . . . . 28 January 2005
  - V1.51 data accessible on GES DISC, starting . . . . . 15 February 2005
  - Released MLS V1.51 Data Quality Documents . . . . . 1 August 2005
  - All backlog processing completed for V1.51 . . . . . 25 October 2005
  - Aura Science Meeting, The Hague, Netherlands . . . . . 8 November 2005
  - V1.52 of Level 2 PGE (no Band 13 data) . . . . . March 2006
  - Achieved Mission Success Criteria . . . . . 13 August 2006
  - Aura Science Meeting, Boulder, Colorado . . . . . 11-15 September 2006
  - Begin production with Version 2.20 . . . . . .December 2006
  - Update production with Version 2.21 . . . . . March 2007
  - Released MLS V2 Data Quality Document (public release) . . . . . May 2007
  - Aura Science Meeting, Pasadena, California . . . . . 1-5 October 2007

MLS Instrument continues nominal operations

- The MLS Instrument Operations Team (IOT) continues to conduct routine and special instrument operational activities from the Instrument Support Terminal at JPL
- Nominal operations includes a monthly Antenna Actuator Assembly lubricant redistribution sweep (AAA reconditioning)
- Nominal instrument mode has all bands active except Band 13 (HCl)
- Only one major problem in the last year that resulted in loss of science measurements:
  - Electronics for 640 GHz radiometer shutdown unexpectedly on July 14, 2007
  - Returned to nominal operations on August 7, 2007
  - The other four radiometers continued to make useful measurements
- Since start of science operations on 13 August 2004, 96% of all possible measurements have resulted in science measurements
  - Non-measurement times include routine maintenance, moon in field of view, moon in space view, special calibration scans, HIRDLS pitch maneuvers, Aura drag makeup maneuvers, and instrument anomalies

Instrument Status



Science Processing/SIPS

SIPS continues routine data production

- SIPS operations
  - Although we are funded for 8/5 staffing, SIPS has been very successful in a 24/7 operations – excellent team at Raytheon, Pasadena shared with TES
  - Data flow from GES-DAAC has been mostly consistent and timely
  - Issues worked via email, phone calls, and biweekly telecons between SIPS and GES-DAAC in a timely manner - GES-DAAC has been very responsive
- Level 1 processing is active with v2.21
  - Processing MLS Level 0 data to Level 1 on a daily basis as data arrives
  - Retro processing in sync with Level 2
- Level 2 processing is active with v2.21
  - Using three clusters to process about 70 days per month
- Level 3 products wait to be validated
- Data delivery to MLS SCF is active
- Data delivery to GES-DISC is active
- Re-design of SIPS file system is under test

Science Data Products

Science team inspects all science products and reviews them at the weekly science team meetings

- Routine archiving of Level 1b and Level 2 products at GES-DISC
- Preliminary Validated (V1.5) products
  - Began in February'05 with PGEs v1.51
  - Released Data Quality Document in August'05
    - data became public
  - Stopped production with v1.5 at the end of February'07
- Validated (V2.2) products
  - Began production in December 2006 with PGEs v2.20
  - Updated PGEs to v2.21 in March'07
  - Released Data Quality Document in May'07
    - data became public
  - Approximately 53% of data processed to Level 2

Level 2 Processing Status, V2.2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Aug-04								221					226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244
Sep-04	245	246	247	248	249	250	251			254			257			260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	
Oct-04	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289				293	294	295	296	297	298	299	300	301	302	303	304	305
Nov-04	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	
Dec-04	335	336	337	338	339	340		342			345	346	347	348	349	350	351	352	353		356	357	358	359	360	361	362	363	364	365	
Jan-05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Feb-05	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59			
Mar-05	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Apr-05	91	92	93	94			97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	
May-05	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137		139	140	141	142	143	144	145	146	147	148	149	150	151
Jun-05	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	
Jul-05	182	183	184	185	186	187	188	189	190	191	192	193		195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
Aug-05	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
Sep-05	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	
Oct-05	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292		294	295	296	297	298	299	300	301	302	303	304
Nov-05	305		307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	
Dec-05	335	336	337	338	339	340	341	342	343		345	346	347	348	349	350	351		353	354	355	356	357	358	359	360	361	362	363	364	365
Jan-06	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Feb-06	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52		54	55	56	57	58	59			
Mar-06	60	61	62	63	64	65	66		68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87			
Apr-06					95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	
May-06	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
Jun-06	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	
Jul-06	182	183	184	185	186	187	188	189	190		192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
Aug-06	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
Sep-06	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	
Oct-06	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304
Nov-06	305	306		308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333		
Dec-06	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365
Jan-07	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Feb-07	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59			
Mar-07		61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
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May-07	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
Jun-07	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	
Jul-07	182	183	184	185	186	187	188	189	190	191	192	193		195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
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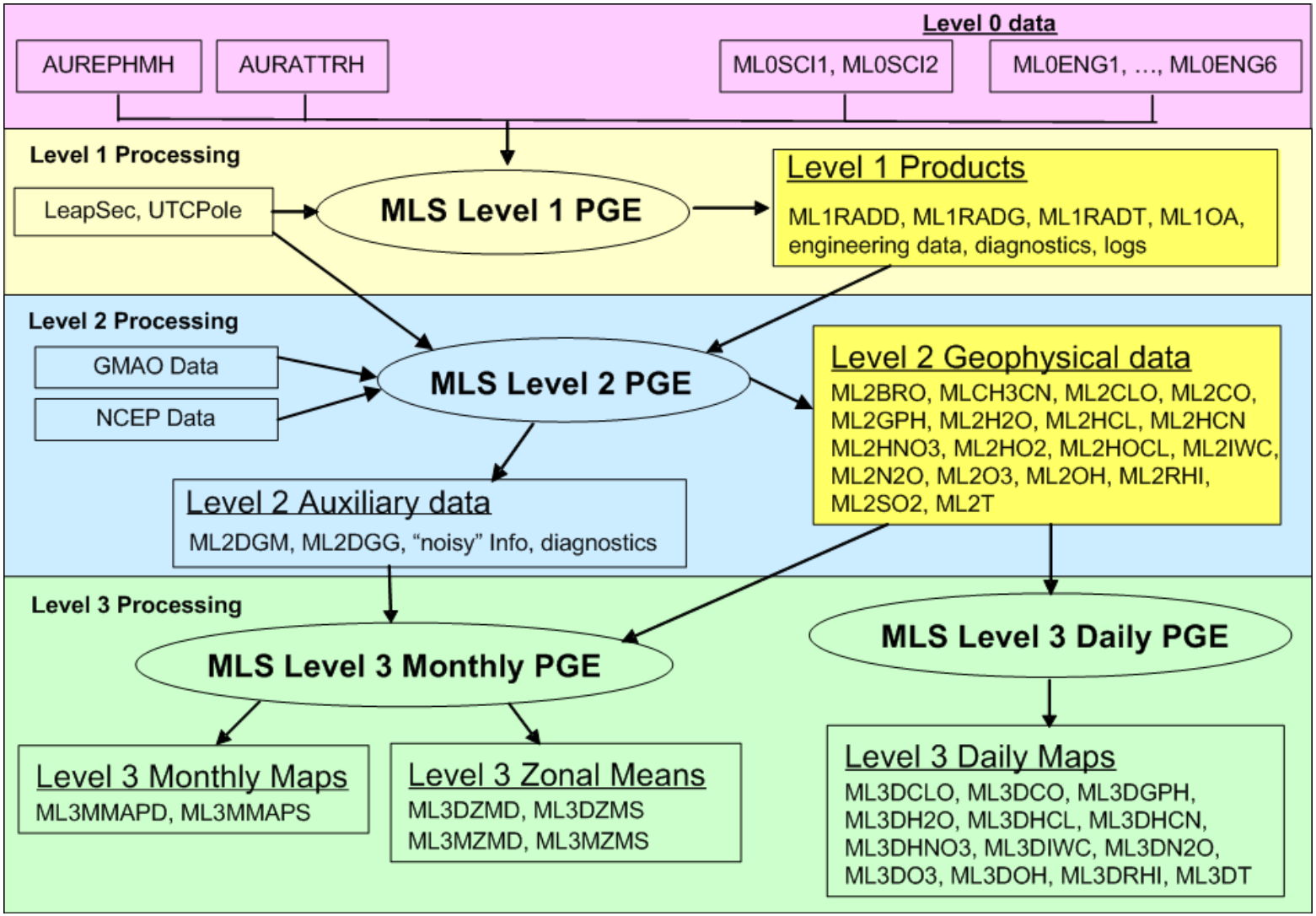
Data Flow Diagram



Science Data Products

Level 1B and Level 2 Products for Version 2

Short Name	Geophysical Parameter		Short Name	Geophysical Parameter
ML1RADD	L1 Radiances from DACS		ML1RADT	L1 Radiances from THz
ML1RADG	L1 Radiances from GHz		ML1BOA	L1 Orbit and Attitude
ML2BRO	L2 Bromine Monoxide		ML2HOCL	L2 Hypochlorous Acid
ML2CLO	L2 Chlorine Monoxide		ML2IWC	L2 Ice Water Content
ML2CO	L2 Carbon Monoxide		ML2N2O	L2 Nitrous Oxide
ML2CH3CN	L2 Methyl Cyanide		ML2O3	L2 Ozone
ML2GPH	L2 Geopotential Height		ML2OH	L2 Hydroxyl
ML2H2O	L2 Water Vapor		ML2RHI	L2 Relative Humidity w/ ice
ML2HCL	L2 Hydrogen Chloride		ML2SO2	L2 Sulfur Dioxide
ML2HCN	L2 Hydrogen Cyanide		ML2T	L2 Temperature
ML2HNO3	L2 Nitric Acid		ML2DGG	L2 Diagnostic, GP Grid
ML2HO2	L2 Hydroperoxy		ML2DGM	L2 Diagnostic, Misc. Grid

Science Data Products – continued

Level 3 Products for Version 2

Short Name	Geophysical Parameter		Short Name	Geophysical Parameter
ML3DZMS	L3 Daily Zonal Mean, Standard		ML3DZMD	L3 Daily Zonal Mean, Diagnostics
ML3MZMS	L3 Monthly Zonal Mean, Standard		ML3MZMD	L3 Monthly Zonal Mean, Diagnostics
ML3MMAPS	L3 Monthly Maps, Standard		ML3MMAPD	L3 Monthly Map, Diagnostics
ML3CLO	L3 Daily Map, Chlorine Monoxide		ML3IWC	L3 Daily Map, Ice Water Content
ML3CO	L3 Daily Map, Carbon Monoxide		ML3N2O	L3 Daily Map, Nitrous Oxide
ML3GPH	L3 Daily Map, Geopotential Height		ML3DO3	L3 Daily Map, Ozone
ML3H2O	L3 Daily Map, Water Vapor		ML3DOH	L3 Daily Map, Hydroxyl
ML3HCL	L3 Daily Map, Hydrogen Chloride		ML3DRHI	L3 Daily Map, Relative Humidity w/ ice
ML3HCN	L3 Daily Map, Hydrogen Cyanide		ML3DT	L3 Daily Map, Temperature
ML3HNO3	L3 Daily Map, Nitric Acid			

Current and Future Development

Team busy in three major areas

- V2.22 PGEs
  - To improve throughput performance without changing data quality
  - Plan to accomplish this with the use of Intel compiler and code changes
  - Currently testing and investigating results
- Near Real Time processing for use in data assimilation
  - Developed special purpose algorithm to produce temperature and ozone quickly
  - Produced about 3 months of test data
  - Plan to set up a processing stream at the SIPS
  - GES-DISC to process Level 0 and Aura ephemeris and attitude for near real time processing
  - Future work to develop special purpose algorithms for water and geopotential height
- SIPS re-design of file system
  - Includes ability to take advantage of remote processor
  - Eliminates redundant data store
  - Replaces aging hardware

Aids to Users

Help is available to user in many ways in addition to those available through GES-DISC

- MLS home page provides useful information and links to others
  - http://mls.jpl.nasa.gov/
- MLS provides Data Quality Document
  - Available through the main MLS web page
- MLS provides user registration
  - Provides updates to instrument and processing status
- Users can ask for help via email: data@mls.jpl.nasa.gov
- MLS provides both IDL and Matlab readers for the Level 2 products through Open Channel Software that distributes software for Caltech/JPL
  - http://www.openchannelsoftware.org/projects/Read_MLS_Level_2_Geophysical_P/ - IDL
  - http://www.openchannelsoftware.org/projects/Read_MLS_Level_2_Geophysical_2/ - Matlab

Summary

- Status Summary
  - MLS instrument continues to work well, despite several problems
  - MLS data processing systems operating smoothly
  - Plans are well underway for Version 2.22 although there are challenges
  - Near Real Time data for assimilation is developing
  - SIPS improvements will allow better operations
  - All Level 1B and Level 2 products routinely archived & available from GES DISC

Useful Web Pages

- Microwave Limb Sounder home page
  - http://mls.jpl.nasa.gov/
- IDL Reader for Level 2 products
  - http://www.openchannelsoftware.org/projects/Read_MLS_Level_2_Geophysical_P/
  - http://www.openchannelsoftware.org/projects/Read_MLS_Level_2_Geophysical_2/
- Aura Guidelines
  - http://www.eos.ucar.edu/hirdls/HDFEOS_Aura_File_Format_Guidelines.pdf
- EOS Data Gateway (EDG)
  - http://delenn.gsfc.nasa.gov/~imswww/pub/imswelcome/
- GES DISC Datapool
  - http://disc.sci.gsfc.nasa.gov/data/datapool/MLS/
- GES-DISC Interactive Online Visualization and Analysis Infrastructure (Giovanni)
  - http://acdisc.sci.gsfc.nasa.gov/Giovanni/mls/